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# I-10/SR 85 CORRIDOR PROFILE STUDY

## I-10/SR 85, CALIFORNIA STATE LINE TO I-8

ADOT Work Task No. MPD 013-16  
ADOT Contract No. 11-013164

### Draft Working Paper 5: Strategic Solutions

SEPTEMBER 2016

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Arizona Department of Transportation



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*This report was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, and for the use or adaptation of previously published material, presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration, U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names that may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. government and the State of Arizona do not endorse products or manufacturers.*

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# LIST OF ABBREVIATIONS

Abbreviation	Name	Abbreviation	Name
ADOT	Arizona Department of Transportation	SR 85	State Route 85
AZTDM	Arizona Travel Demand Model	TI	Traffic Interchange
DCR	Design Concept Report	TIP	Transportation Improvement Plan
EB	Eastbound	TPTI	Truck Planning Time Index
FY	Fiscal Year	TTI	Travel Time Index
HCRS	Highway Condition Reporting System	TTTI	Truck Travel Time Index
HERE	Real time traffic conditions database produced by American Digital Cartography Inc.	UP	Underpass
HPMS	Highway Performance Monitoring System	V/C	Volume to Capacity Ratio
I-10	Interstate 10	WB	Westbound
LOS	Level of Service		
MP	Milepost		
OP	Overpass		
MAG	Maricopa Association of Governments		
P2P	Planning to Programming		
PDI	Pavement Distress Index		
PSR	Pavement Serviceability Rating		
PTI	Planning Time Index		
SHSP	Strategic Highway Safety Plan		
SPUI	Single Point Urban Interchange		

## 1. INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study of Interstate 10 (I-10) East between the California State Line and Arizona State Route 85 (SR 85), and SR 85 between I-10 and Interstate 8 (I-8). This study will look at key performance measures relative to the I-10/SR 85 Corridor, and the results of this performance evaluation will be used to identify potential strategic improvements.

The intent of the corridor profile program, and of the Planning to Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network. ADOT is conducting eleven corridor profile studies. The eleven corridors are being evaluated within three separate groupings.

The first three studies (Round 1) began in spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Mexico International Border to I-10
- I-40: California State Line to I-17

The second round (Round 2) of studies, initiated in spring 2015, include:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

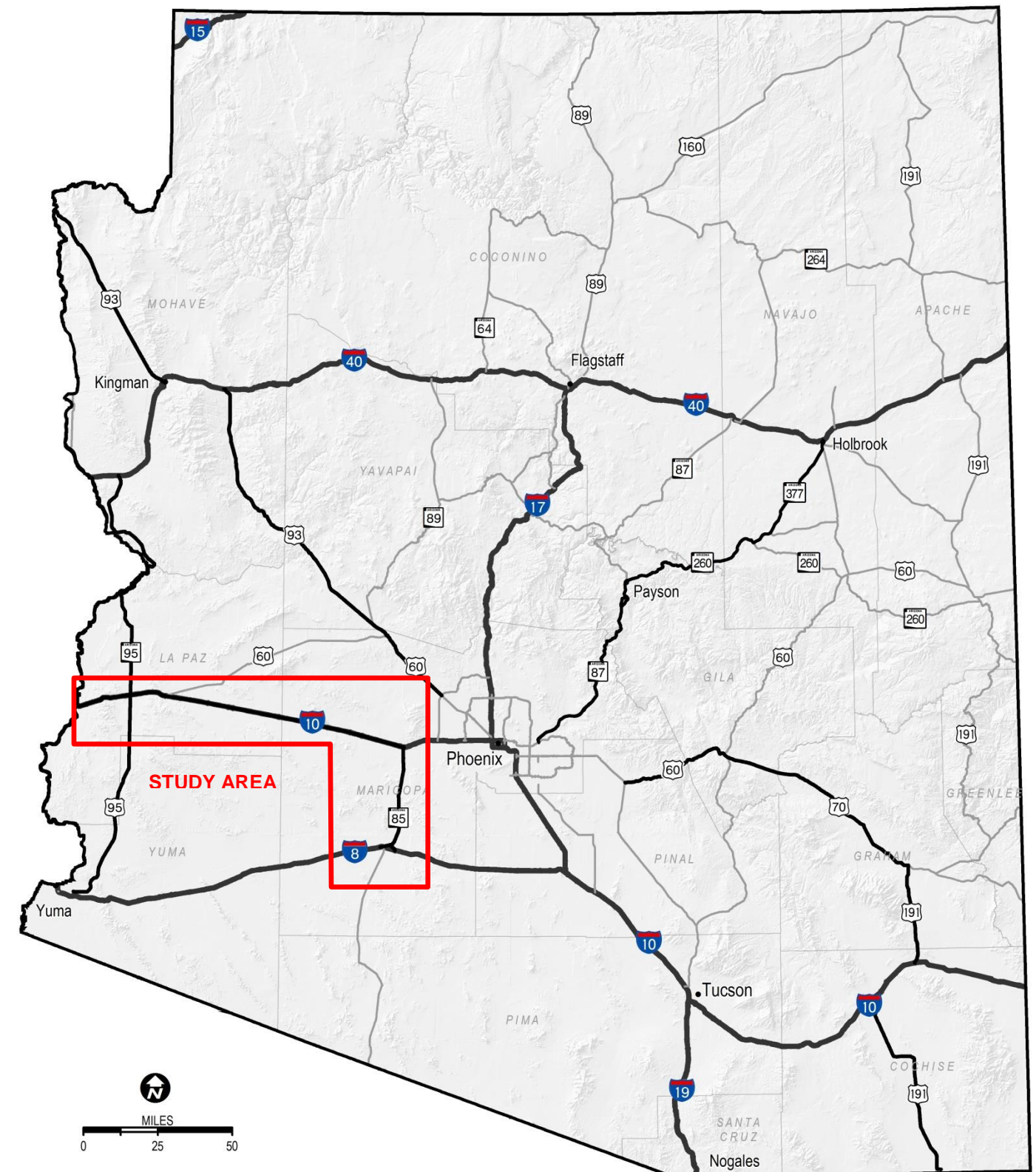
The third round (Round 3) of studies, initiated in fall 2015, include:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to the New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 60/US 93: Nevada State Line to SR 303L

The studies under this program will assess the overall health, or performance, of the state's strategic highways. The Corridor Profile Studies will identify candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

I-10/SR 85, California State Line to I-8, depicted in **Figure 1**, is one of the strategic statewide corridors identified and is the subject of this Round 3 Corridor Profile Study.

Figure 1: Corridor Study Area: I-10/SR 85



## 1.1 Corridor Study Purpose

The purpose of the I-10/SR 85 Corridor Profile Study is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process established by the previous Round 1 and Round 2 corridor profile studies to:

- Inventory past improvement recommendations.
- Define corridor goals and objectives.
- Assess existing performance based on quantifiable performance measures.
- Propose various solutions to improve corridor performance.
- Identify specific projects that can provide quantifiable benefits relative to the performance measures.
- Prioritize projects for future implementation.

## 1.2 Corridor Study Goals and Objectives

The objective of this study is to identify a recommended set of potential strategic solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The I-10/SR 85 Corridor Profile Study will define solutions and improvements for I-10/SR 85 that can be evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals have been identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Match solutions with deficiencies in measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

## 1.3 Working Paper 5 Overview

The objective of Working Paper 5 is to document the development of strategic solutions derived from a performance-based needs assessment for the I-10/SR 85 Corridor. Corridor needs were defined in Working Paper 4 through a review of the difference between baseline performance (Working Paper 2) and desired performance (Working Paper 3).

## 1.4 Corridor Overview

The I-10/SR 85 Corridor provides an important connection from Southern California to economic and recreational opportunities in Central Arizona and other destinations to the east. I-10 is a 4-lane divided freeway from the California border to SR 85 while SR 85 is generally a two-lane highway facility connecting I-10 to I-8. Together, the two roadways provide a passage from Southern California to Tucson while bypassing the Metropolitan Phoenix Area.

Plans have been made to upgrade SR 85 to a freeway facility between I-10 and I-8, which will greatly increase accessibility for both freight and tourism travel. I-10 between California and SR 85 is a direct connection between Phoenix and Los Angeles. Similarly, SR 85 between I-10 and I-8 is both a bypass route for freight traffic wishing to avoid the Phoenix Area and a major corridor in the linkage between Phoenix and San Diego. Therefore, the entire corridor is considered an important connection for both freight and tourism travel in the state.

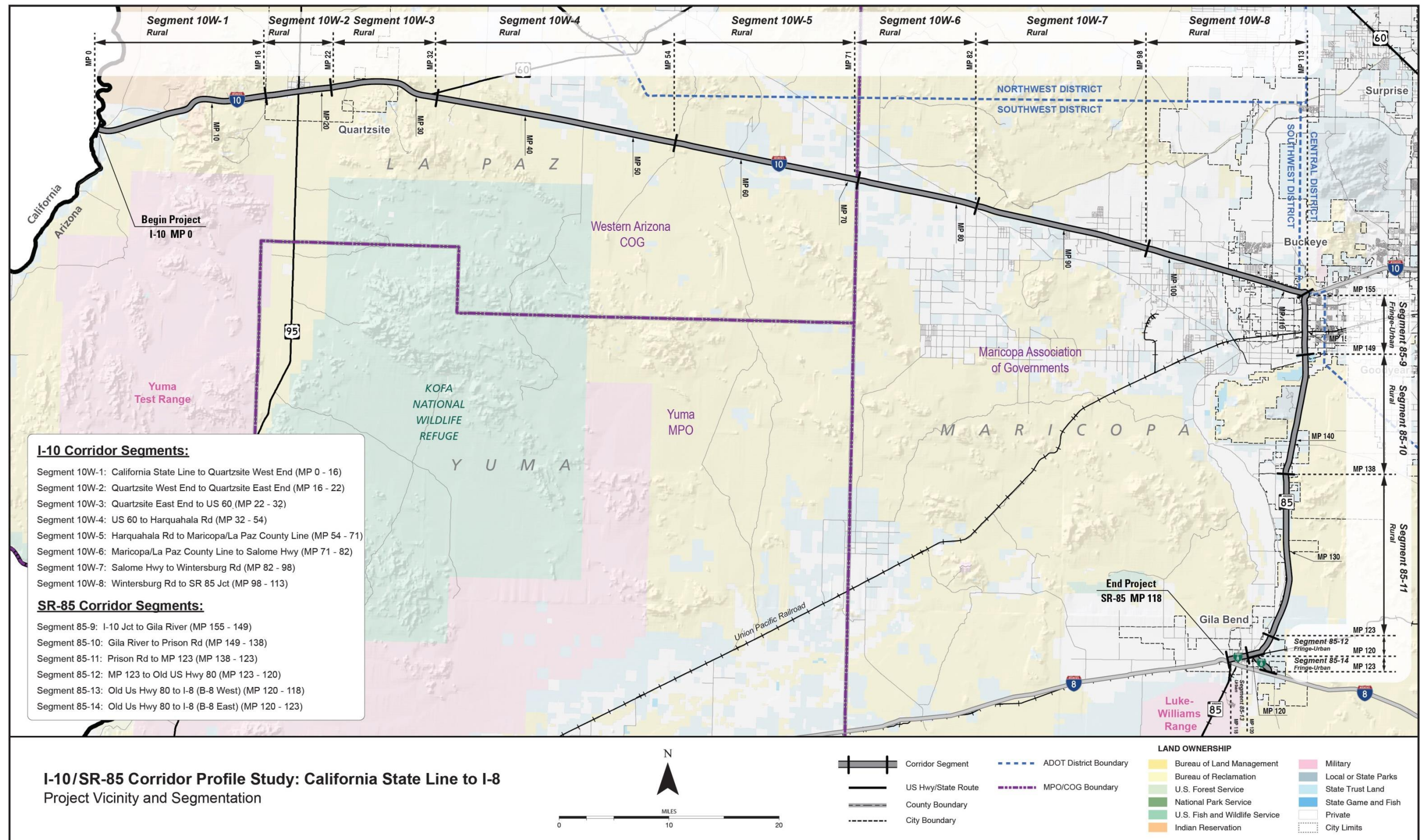
## 1.5 Study Location and Corridor Segments

The I-10/SR 85 Corridor extends from the California State Line (MP0) to SR 85 (MP 113) and from I-10 (MP 155) to I-8 (MP 118) on SR 85, which is approximately 150 miles. This corridor provides a bypass to downtown Phoenix from the south and west and connects I-10 and I-8. Identification of highway segments was determined based on roadway, traffic and jurisdictional characteristics to allow for the appropriate level of analysis for similar operating environments between segments. Fourteen segments have been identified as described in **Table 1** and illustrated in **Figure 2**. Based on team input and data collection, the segment limits may be adjusted as the study progresses.

**Table 1: I-10/SR 85 Corridor Segments and Descriptions**

Segment	Route	Begin	End	Approx Begin MP	Approx End MP	Approx Length (mi)	Through Lanes	2014 AADT Volume (VPD)	Character Description
10W-1	I-10	California State Line	West Quartzsite	0	16	16	2 EB, 2 WB	16,000 - 20,000	This segment includes the Ehrenberg Port of Entry at milepost 3.8 which is a required checkpoint for commercial traffic entering Arizona. It is a four-lane divided section that has been classified as a rural operating environment.
10W-2	I-10	West Quartzsite	East Quartzsite	16	22	6	2 EB, 2 WB	16,000 - 21,600	This segment passes through Quartzsite and includes the I-10/SR 95 junction. It is six miles long and sustains consistent traffic volumes on a four-lane section.
10W-3	I-10	East Quartzsite	Jct US 60	22	32	10	2 EB, 2 WB	18,500 - 21,600	This segment is 10 miles long between the eastern border of Quartzite and the I-10/US 60 junction. It has been classified as a rural environment and it is mostly flat with traffic volumes 16,000 to over 20,000 vehicles per day.
10W-4	I-10	Junction US 60	Harquehala Rd	32	54	22	2 EB, 2 WB	20,400 - 21,500	This segment is 22 miles long between the US 60 junction and Harquehala Road. It is a four-lane section that has been classified as a rural environment.
10W-5	I-10	Harquehala Rd	La Paz/ Maricopa County Border	54	71	17	2 EB, 2 WB	19,100 - 21,500	This segment runs from Eastern La Paz County to the Maricopa County border. It is 17 miles long and has been classified as a rural environment.
10W-6	I-10	La Paz/ Maricopa County Border	Salome Rd	71	82	11	2 EB, 2 WB	19,100 - 20,500	This segment is 11 miles long, includes two general purpose lanes in each direction, and has been classified as a rural environment.
10W-7	I-10	Salome Rd	Wintersburg Rd	82	98	16	2 EB, 2 WB	20,500 - 25,500	This segment includes the Town of Tonopah. It is a four-lane section where traffic volumes begin to increase towards the east.
10W-8	I-10	Wintersburg Rd	I-10/SR 85 Interchange	98	I-10 113, SR 85 155	15	2 EB, 2 WB	25,500 - 32,200	This segment is 15 miles long and includes the portion of I-10 that serves as a principal evacuation route for the Palo Verde Nuclear Generating Station, which is located six miles south of I-10. It is a four-lane section, it has been classified as a rural environment, and it has over 25,000 vehicles per day.
85-9	SR 85	I-10/SR 85 Interchange	Gila River (MP 149)	I-10 113, SR 85 155	149	6	2 EB, 2 WB	15,100 - 13,700	This segment is a 4-lane section that connects I-10 south to the Gila River. It passes through the western portion on the Town of Buckeye and has been classified as a fringe urban operating environment.
85-10	SR 85	Gila River (MP 149)	Patterson Rd/ Prison Access	149	138	11	2 NB, 2 SB	15,100 - 8,900	This segment is 11 miles long and is a four-lane divided section. The southern limit provides direct access to the Arizona State Prison complex.
85-11	SR 85	Patterson Rd/ Prison Access	Gila Bend Limits	138	123	15	2 NB, 2 SB	8,900 - 10,600	This segment starts at the southern limits of Buckeye and ends at approximately the northern limits of Gila Bend. It is a 4-lanedivided section and has been classified as a rural environment.
85-12	SR 85	Gila Bend Limits	Jct B-8	123	120	3	2 NB, 2 SB	10,600 - 12,000	This segment transitions to one lane in each direction on a non-divided section. The speed limit drops entering into Gila Bend and this segment has been classified as fringe urban.
85-13	B-8	Jct B-8	Jct I-8 WB	120	118	2	2 EB, 2 WB, 1 LT	9,300 – 11,500	This segment starts at SR 85 and transitions onto B-8 through Gila Bend. It is a five-lane arterial section with a dedicated left-turn lane. This segment provides direct access to commercial businesses within Gila Bend and acts as an arterial roadway.
85-14	B-8	Jct B-8	Jct I-8 EB	SR 85 120	123	3	1 NB, 1 SB	12,000 – 12,100	This segment starts at SR 85 and transitions onto S Butterfield Trail. It is a two lane non-divided section that provides access to I-8 without going through Gila Bend. Various commercial businesses have direct access to this segment as well.

Figure 2: I-10/SR 85 Study Area/Segmentation Map



## 2.0 SUMMARY OF CORRIDOR NEEDS

### 2.1 Summary of Needs

Working Paper 4 documented performance-based needs assessment process and the results for the I-10/SR 85 Corridor. The needs in each performance area were classified as either None, Low, Medium, or High based on a comparison of the corridor performance (Working Paper 2) to the performance objectives (Working Paper 3).

As documented in Working Paper 4, the needs for each segment were numerically combined to estimate the average level of need for each corridor segment. During the corridor study process for I-10/SR 85, the Mobility, Freight, and Safety performance areas were identified as emphasis areas. Therefore, during the calculation process a weighting factor of 1.50 was applied to the average need score in these performance areas. The table at the bottom of Figure 3 shows the level of need for each segment by performance area, and the numeric average need for each segment.

Step 5 translates the performance-based needs into corridor needs that are “actionable”. These needs can facilitate development of solution sets (projects, initiatives, countermeasures, and programs) to improve corridor performance through strategic investments in preserving, modernizing, and/or expanding the corridor. Corridor needs were developed through a segment-by-segment review of needs across performance areas.

The bullets below and referenced figure reflect the current needs analysis results for the I-10/SR 85 Corridor and are the basis for the evaluation and resulting candidate solutions of this working paper.

#### Pavement Performance Area

- Pavement failure hot spots were identified on 1 mile of Eastbound I-10, 3 miles of Westbound I-10, and 3 miles of Northbound SR 85.
- Segment 10-4 appears to have a higher level of need in percentage of pavement failure, which may warrant consideration of alternative treatments on the concentrated area.

#### Bridge Performance Area

- There are zero bridge Hot Spots within the I-10/SR 85 Corridor
- 7 of the 14 segments within the I-10/SR 85 Corridor exhibit Bridge needs
- Only 1 bridge has a current rating of multiple 5’s.
- 7 bridges have current deck ratings of 5.
- 3 bridges indicate as Functionally Obsolete in the I-10/SR 85 Corridor
- Only 1 bridge, Tom Wells Rd TI UP at MP 5.84, has potential repetitive investment issues which may be a candidate for life-cycle cost analysis to evaluate alternative solutions.

#### Mobility Performance Area

- Future (2035) travel demand is anticipated to exceed capacity on approximately 13% of corridor, generally in Buckeye near the I-10/SR 85 Junction, and in Gila Bend.
- A higher than average number of closures, primarily due to accidents and or incidents, occurs on SR 85 from MP 155-149 possibly due to the I-10/SR 85 System Interchange.
- The PTI in Westbound Segment 10-1 exhibits high levels of need due to the California border and Port of Entry. Additionally PTI levels in Northbound Segments 85-13 and 85-14 exhibit high levels of need possibly due to construction activity over the timeframe in which data was collected, and Segment 85-13 serving as Main Street for Gila Bend.

#### Safety Performance Area

- Safety Needs were identified in ten of fourteen segments, 130 miles (86%) of the corridor.
- The highest levels of need have been identified from MP 32 to 98 on the I-10 portion of the Corridor and from MP 155-149 on the SR 85 portion of the Corridor.
- More than half of the crashes involve single vehicle, which may indicate events due to excessive speed.
- Elevated numbers of rear-end crashes in Segment Northbound 85-9 due to large trucks slowly merging on to I-10 at the Junction.
- Segments 85-10 through 85-14 have too small of a sample to present accurate data.

#### Freight Performance Area

- The highest level of need was identified on SR 85 from MP 155 to 149 due to the I-10 and SR 85 System Interchange, and B 8 MP 120-118 and 120-123 possibly due to construction. MP 0-16 on I-10 exhibits a medium level of need, due to the Ehrenberg Port of Entry.
- 100% of closures were related to incidents/accidents along the Corridor.
- There are two Bridge Clearance Hot Spots in the Corridor, Ramsey Mine Rd UP located at MP 33.78 and 355<sup>th</sup> Ave UP located at MP 101.4.

## 2.2 Strategic Investment Areas

The principal objective of the corridor profile study is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State’s key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need (Medium or High). Addressing areas of Medium or High need will have the greatest effect on the corridor performance and are the focus of the strategic solutions. Segments with Medium or High needs and specific locations of hot spots are considered candidates for strategic solutions. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The areas of the I-10/SR 85 Corridor identified for potential strategic investments are shown in **Figure 4**.

Figure 3: I-10/SR 85 Summary of Needs

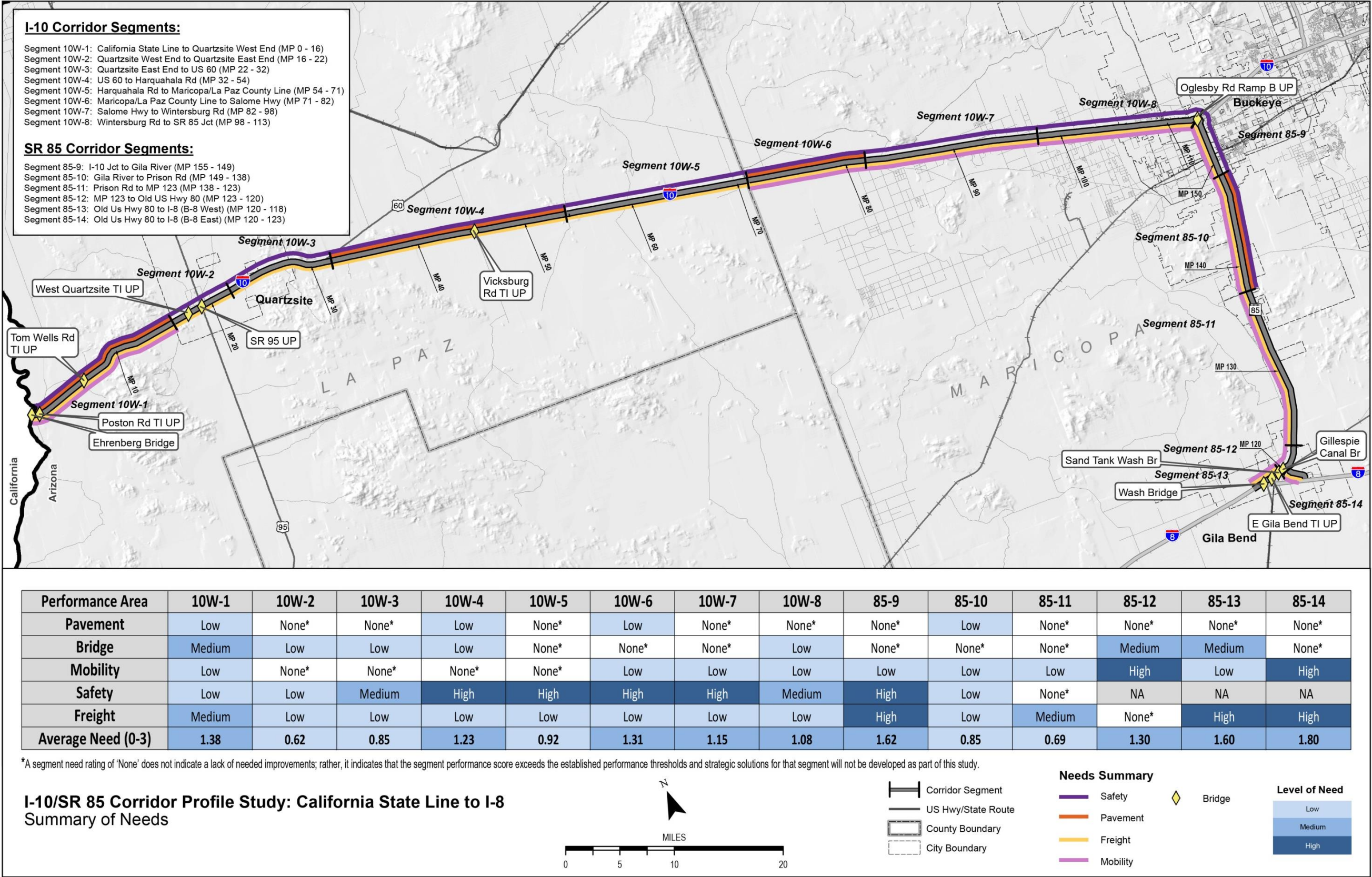
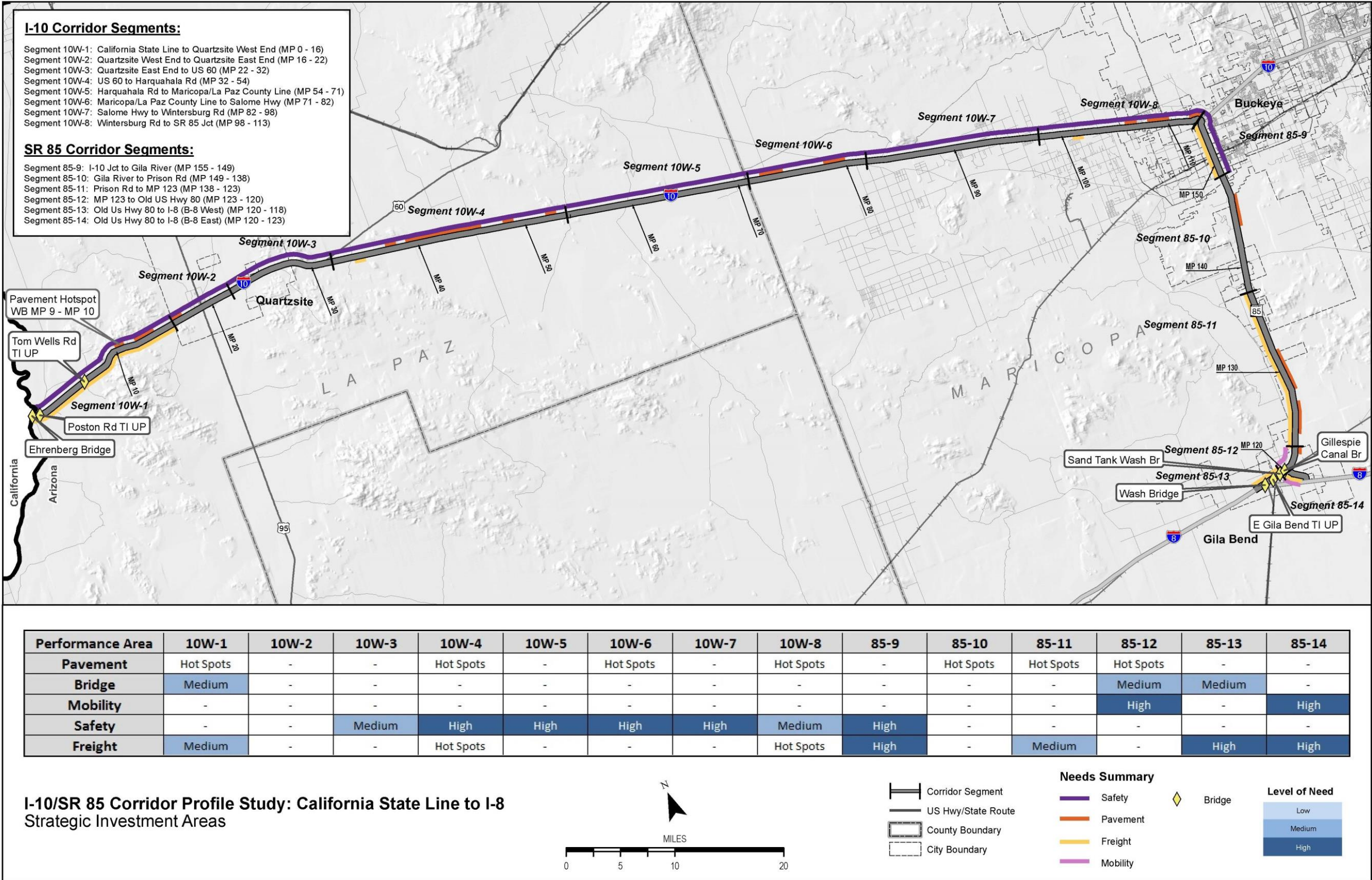


Figure 4: I-10/SR 85 Strategic Investment Areas



### 3.0 STRATEGIC INVESTMENT AREA SCREENING

This section examines qualifying strategic needs and determines if the needs in those locations require action. **Table 2** notes if each potential strategic location will advance to solution set development, and if not, the reason for screening that location out of the solution development process. Locations advancing to solutions development are marked with Yes (Y); locations not advancing are marked with No (N) and highlighted.

In some cases, elevated needs do not advance to solution development and are screened out from further consideration because they have been or will be addressed through other measures, including:

- A project has already been programmed to address the need.
- The need is a result of a pavement or bridge hot spot that does not show historical investment or rating issues. These hot spots will likely be addressed through other ADOT programming means.
- A bridge is not a hot spot (a bridge is considered a hot spot when it has a single rating of 4 or lower or multiple ratings of 5) but is located within a segment with a Medium or High level

need. This bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes.

- The need is determined to be non-actionable (cannot be addressed through an ADOT project).
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need.

The remainder of the study focuses on developing appropriate solutions for the selected strategic locations. The screening table provides specific information about the needs in each segment considered for strategic investment. The table identifies the elevated needs - either Medium or High segment needs or segments without a Medium or High level of need that have a hot spot.

Each area of need has been assigned a Location Number to help document and track specific locations that are being considered for strategic investment throughout this process.

**Table 2: Strategic Investment Area Screening**

Segment	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
10-1 MP 0-16	Hot Spot	Medium	-	-	Medium	L1	Bridge	Ehrenberg Bridge at MP .01 has current Sub Rating of 5	N	Bridge does not meet criteria for historical review, or have multiple ratings of 5, therefore not considered strategic.
						L2	Bridge	Poston Road TI UP at MP 0.62 has current Deck Rating of 5	N	Bridge does not meet criteria for historical review, or have multiple ratings of 5, therefore not considered strategic.
						L3	Bridge	Tom Wells Rd TI UP at MP 5.84 has Current Deck Rating of 5 and was identified as potentially having a repetitive investment issue	N	Bridge does meet criteria for historical review, however it does not have multiple ratings of 5, therefore not considered strategic
						L4	Pavement	Hot Spots WB MP 9-12 with high level of historical investment	Y	
						L5	Pavement	Hot Spots WB MP 15-16 with high level of historical investment	Y	
						L6	Pavement	Hot Spots EB MP 12-13 with high level of historical investment	Y	
						L7	Freight	Freight Needs primarily associated with elevated Eastbound TPTI levels.	N	Elevated TPTI due to truck stop location in EB direction, considered non-actionable therefore not strategic

Segment	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
10-2 MP 16-22	-	-	-	-	-	No Strategic Needs Identified				
10-3 MP 22-32	-	-	-	Medium	-	L8	Safety	Hot Spots at WB MP 25 and 29. Crash trends show overturning (54%), speed too fast for conditions (54%), and running off of the road (38%). Driver and road conditions show no safety device usage (23%), involve wet conditions (15%), and under the influence of drugs or alcohol (8%).	Y	
10-4 MP 32-54	Hot Spot	-	-	High	Hot Spot	L9	Freight	Ramsey Mine Rd UP at MP 33.78 cannot be ramped around	N	Reprofiling Project will mitigate issue; Tracs #: 010 LA 29 H871201D
						L10	Pavement	Hot Spots EB MP 36-45 with medium level of historical investment	N	Project is programmed for FY 16 to mitigate issues; Tracs #: 010 LA 29 H871201D
						L11	Safety	Hot Spots at EB MP 35, 37 and 42, and at WB MP 49. Crash trends show overturning (57%), collision with another vehicle (22%), and involve speed too fast for conditions (57%). Driver and road conditions show fatigue and/or fell asleep (24%), no shoulder or lap belt used (19%), and involve dry conditions (100%).	Y	
						L12	Pavement	Hot Spots WB MP 41-42 with medium level of historical investment	N	Project is programmed for FY 16 to mitigate issues; Tracs #: 010 LA 29 H871201D
						L13	Pavement	Hot Spots WB MP 47-48 with medium level of historical investment	N	Does not meet criteria for previous investment, therefore not considered strategic
						L14	Pavement	Hot Spots EB MP 47-48 with medium level of historical investment	N	Does not meet criteria for previous investment, therefore not considered strategic
						L15	Pavement	Hot Spots WB MP 51-52 with medium level of historical investment	N	Does not meet criteria for previous investment, therefore not considered strategic
10-5 MP 54-71	-	-	-	High	-	L16	Safety	Hot Spots at EB MP 61-62. Crash trends show collision with another vehicle (35%), rear-end collisions (27%), and involve speed too fast for conditions (46%). Driver and road conditions show occurrences in dark-unlighted conditions (38%), fatigue or fell asleep (15%), and no shoulder and lap belt used (15%).	Y	

Segment	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
10-6 MP 71-82	Hot Spot	-	-	High	-	L17	Safety	Hot Spots at WB MP 70-74. Crash trends show overturning (72%), involving a rear-end collision (22%), and involving inattention or distraction (22%). Driver and road conditions show influence of drugs or alcohol (11%), dry conditions (100%), and occurrences in dark or unlighted conditions (33%).	Y	
						L18	Pavement	Hot Spots WB MP 71-73 with low level of historical investment	N	Does not meet criteria for historical investment and project is programmed for FY 19 should mitigate issues; Tracs #: 010 MA 70 H892301C
						L19	Pavement	Hot Spots EB MP 77-79 with low level of historical investment	N	Does not meet criteria for historical investment and project is programmed for FY 19 should mitigate issues; Tracs #: 010 MA 70 H892301C
10-7 MP 82-98	-	-	-	High	-	L20	Safety	Hot Spots at EB MP 82 and 86-88. Crash trends show overturned vehicles (54%), involving speed too fast for conditions (29%), and involve a single vehicle (67%). Driver and road conditions show no shoulder and lap belt used (13%), influence of drugs or alcohol (8%), and involving dry conditions (96%).	Y	
10-8 MP 98-113	Hot Spot	-	-	Medium	Hot Spot	L21	Freight	355 <sup>th</sup> Ave UP at MP 101.4 has a low clearance and no ramp around option for oversized vehicle traffic	Y	
						L22	Pavement	Hot Spots WB MP 105-106 with medium level of historical investment	N	Issues have been addressed by recent Pavement Preservation Project completed on 2/3/15; Tracs #: H863801C
						L23	Safety	Hot Spots at EB MP 107, 109-112, and WB MP 111-112. Crash trends show involving a single vehicle (65%), vehicle overturning (55%), and speed too fast for conditions (45%). Driver and road conditions show no shoulder and lap belt being used (20%), no apparent influence (60%), and involving dry conditions (100%).	Y	
						L24	Pavement	Hot Spots EB MP 107-109 with medium level of historical investment	N	Issues will be addressed through district maintenance Pavement Preservation Project; Tracs #: H863801C
						L25	Pavement	Hot Spots EB MP 112-113 with medium level of historical investment	N	Issues will be addressed through district maintenance Pavement Preservation Project; Tracs #: H863801C
85-9 MP 155-149	-	-	-	High	High	L26	Safety	Hot Spots at NB MP 153 and SB MP 154. Crash trends show collisions involving motor vehicles (87%), involving running a stop sign (40%), and involve an angle (73%). Driver and road conditions show no shoulder or lap belt being used (40%), involve wet conditions (13%), and occurring in dark and unlighted conditions (40%).	Y	
						L27	Freight	Freight needs primarily associated with elevated TPTI levels	Y	

Segment	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
85-10 MP 149-138	Hot Spot	-	-	-	-	L28	Pavement	Hot Spots SB MP 143-146 with low level of historical investment	N	Does not meet criteria for historical investment, therefore not considered strategic
85-11 MP 138-123	Hot Spot	-	-	-	Medium	L29	Pavement	Hot Spots NB MP 123-131 with medium level of historical investment	N	Hot Spots have been addressed by recent pavement preservation project; Tracs #: H873801C
						L30	Freight	Freight needs primarily associated with elevated TPTI levels	N	Elevated levels likely due to the State Prison and Landfill being located within this segment. Considered non-actionable, therefore not strategic
85-12 MP 123-120	Hot Spot	Medium	High	-	-	L31	Pavement	Hot Spots NB MP 122-123 with low level of historical investment	N	Hot Spots have been addressed by recent pavement preservation project; Tracs #: H873801C
						L32	Bridge	Gillespie Canal Bridge at MP 120.25 has a Current Structural Evaluation rating of 5	N	Bridge does not meet criteria for historical investment, and does not have multiple ratings of 5, therefore not considered strategic
						L33	Mobility	Mobility needs primarily associated with elevated current and Future V/C levels, and elevated Bicycle Accommodation levels due to inadequate shoulder widths	Y	
85-13 MP 120-118	-	Medium	-	-	High	L34	Bridge	Wash Bridge at MP 118.15 has a Current Structural Evaluation Rating of 5	N	Bridge does not meet criteria for historical investment, and does not have multiple ratings of 5, therefore not considered strategic
						L35	Bridge	E Gila Bend TI UP at MP 119.42 has a Current Deck Rating of 5	N	Bridge does not meet criteria for historical investment, and does not have a multiple rating of 5, therefore not considered strategic
						L36	Bridge	Sand Tank Wash Bridge at MP 119.76 has a Current Structural Evaluation Rating of 5	N	Bridge does not meet criteria for historical investment, and does not have a multiple rating of 5, therefore not considered strategic
						L37	Freight	Freight needs primarily associated with elevated TPTI and TTTI values	N	Elevated levels likely due to truck stop location at B-8/SR 85 interchange. Considered non-actionable, therefore not strategic
85-14 MP 120-123	-	-	High	-	High	L38	Mobility	Mobility needs primarily associated with elevated current and future V/C values, and elevated TTI and PTI scores. Elevated Bicycle Accommodation levels are due to inadequate shoulder widths	Y	
						L39	Freight	Freight needs primarily associated with elevated TPTI and TTTI values	Y	

## 4.0 CANDIDATE SOLUTIONS

The Corridor Profile Study identifies performance-based strategic solutions (investments) to help inform decision-making processes. This will enable ADOT to direct available funding resources to maximize the performance of the State's key transportation corridors. The corridor profile process is designed to mesh with the P2P Link and assigns strategic solutions to one of three categories for investment:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing strategic solutions for corridor preservation, modernization, and expansion. Strategic solutions are intended to complement ADOT's traditional project development processes through a performance-based analysis to identify needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Strategic solutions developed for key corridors will be considered along with other candidate projects

### 4.1 Characteristics of Strategic Solutions

For the purposes of the corridor profile process, strategic solutions include the following characteristics:

- Do not recreate or replace results from normal programming processes.
- May include programs or initiatives, areas for further study, and infrastructure projects.
- Address elevated levels of need (high or medium) and hot spots.
- Focus on investments in Modernization projects (to optimize current infrastructure).
- Address overlapping needs.
- Reduce costly repetitive maintenance.
- Extend operational life of system and delay expansion.
- Leverage programmed projects that can be expanded to address other strategic elements.
- Provide measureable benefit (benefit/cost ratio, risk, LCCA, performance system, etc.).

### 4.2 Strategic Solutions Types

Establishing uniform solution types enables the corridor profile process to compare proposed solutions on and across corridors to determine effectiveness at improving performance, including cost and risk comparisons to be undertaken in subsequent tasks. **Appendix A** provides a list of the types of candidate solutions and options developed for the corridor profile studies. These candidate solutions were identified and separated into the three funding categories of Preservation, Modernization, or Expansion.

## 4.3 Candidate Solutions

The final step in this task is to identify candidate solutions that will be submitted for further analysis through performance effectiveness evaluation process. The project team accessed a variety of resources to identify solutions to address strategic investment areas:

- Field reviews
- Observable trends from performance analysis
- Discussions with districts
- ADOT technical groups
- Review previous reports
- National best practices
- Professional judgment

**Table 3** identifies each location that has been assigned a candidate solution, with a number (e.g., CS 10.1, 10.2, etc.). Each candidate solution is comprised of one or more components to address the identified needs. The assigned CS numbers are linked to the location numbers to provide tracking capability back to the screening process. The locations of proposed solutions are shown in **Figure 5**.

In some cases, multiple solutions are proposed for a single location. Solutions that are proposed to address the same need location with alternate approaches (e.g., Option A, B, or C) are advanced to the Life Cycle Cost and Benefit Cost Analysis evaluation in Task 6 to provide insights into the cost effectiveness of these options so a recommended solution can be identified. In locations where only one option has been developed, the next step will be to advance that solution directly to the solution evaluation process for prioritization.

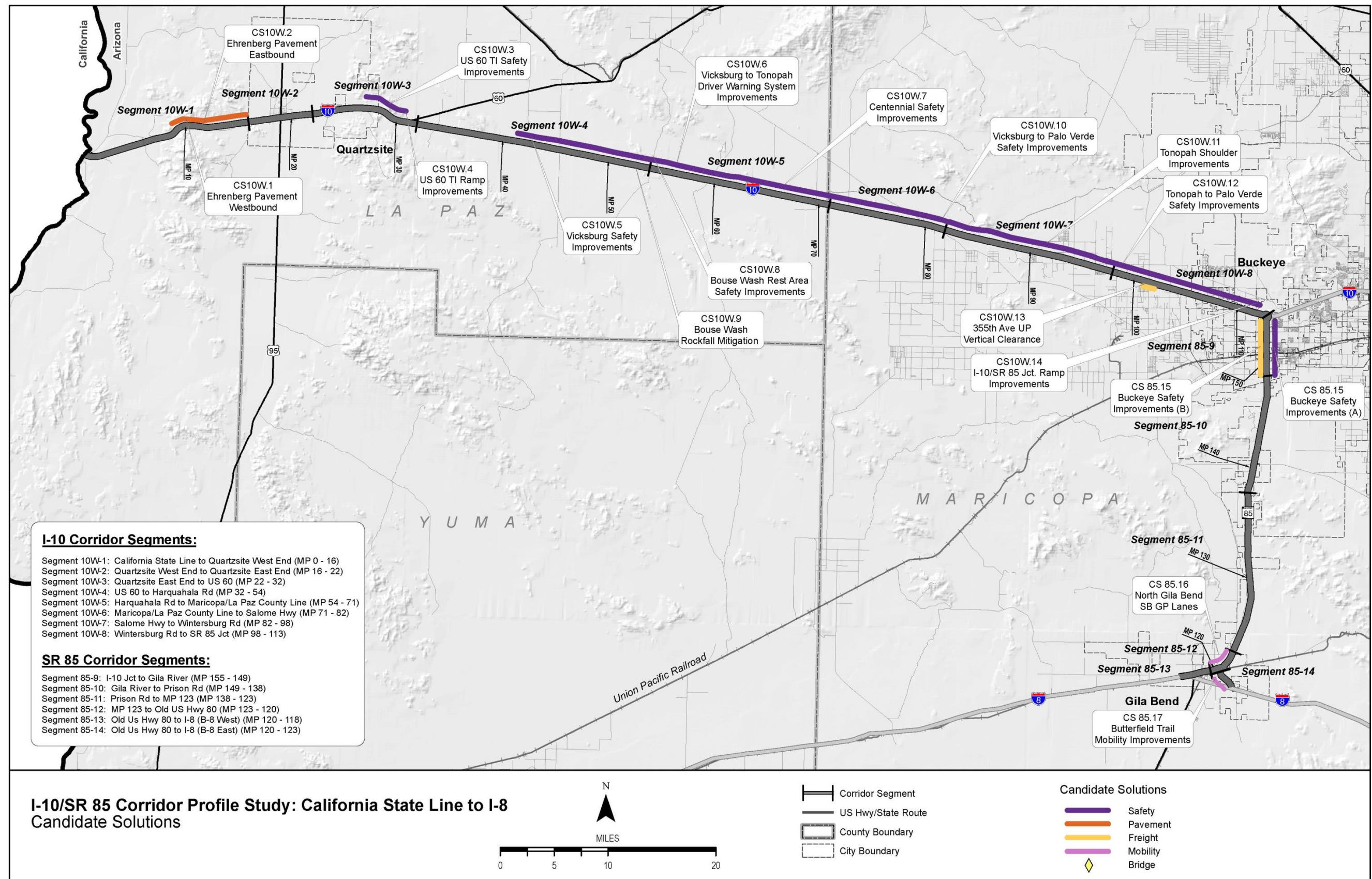
Solutions that are recommended to expand or modify the scope of an already programmed project are noted but are not advanced to solution evaluation and prioritization. These solutions will be directly recommended for programming.

**Table 3: Candidate Construction Program Solutions**

Solution #	Location #	BMP	EMP	Name	Option*	Scope	P/M/E
CS 10W.1	L4, L5	WB 9	WB 16	Ehrenberg Pavement Westbound	A B	Rehabilitate Pavement Replace Pavement	P
CS 10W.2	L6	EB 12	EB 16	Ehrenberg Pavement Eastbound	A B	Rehabilitate Pavement Replace Pavement	P
CS 10W.3	L8	27	31	US 60 TI Safety Improvements	-	Install speed feedback signs WB MP 31 at approach to curve Install Chevrons on curves Improve skid resistance Install raised pavement markings, high-visibility delineators, and high-visibility edge line striping Install safety edge	M
CS 10W.4	L8	31	31	US 60 TI Ramp Improvements	-	Modify entry/exit ramps to parallel configuration	M
CS 10W.5	L11	41	50	Vicksburg Safety Improvements	-	Install safety edge on both sides Install raised pavement markings, high-visibility delineators, and high-visibility edge line striping	M
CS 10W.6	L11, L16, L17	43	81	Vicksburg to Tonopah Driver Warning System Improvements	-	Install wind, blowing dust, and debris warning signs (MP 66, 68, 70, 76, 78, 80) Install RWIS (MP 70 and 77) Install CCTV cameras at EB and WB DMS MP 49.4 Install dynamic speed feedback signs EB MP 49.4	M
CS 10W.7	L11, L16, L17	52	74	Centennial Safety Improvements	-	Install rumble strips Install raised pavement markings, high-visibility delineators, and high-visibility edge line striping Rehab and widen inside shoulder with safety edge Install safety edge on outside shoulder	M
CS 10W.8	L11	52	55	Bouse Wash Rest Area Ramp Improvements	-	Modify entry/exit ramps to parallel configuration	M
CS 10W.9	L11	52.75	53	Bouse Wash Rockfall Mitigation	-	Install rock-fall mitigation (North side of I-10 WB direction)	M
CS 10W.10	L16, L17, L20, L23	54	103	Vicksburg to Palo Verde Lighting Improvements	-	Install lighting at TI merge points (MP 54, 69, 81, 98, 103)	M
CS 10W.11	L20	82	96	Tonopah Shoulder Improvements	-	Install safety edge on outside shoulder Rehab and widen inside shoulder with safety edge	M
CS 10W.12	L20, L23	82	112	Tonopah to Palo Verde Safety Improvements	-	Install raised pavement markings, high-visibility delineators, and high-visibility edge line striping Install CCTV cameras at EB DMS MP 110 Install dynamic speed feedback signs WB MP 85 and EB MP 110 Install safety edge	M
CS 10W.13	L21	101.4	101.4	355 <sup>th</sup> Ave UP Vertical Clearance	A B C	Replace bridge Build ramps Re-profile mainline	M
CS 10W.14	L23	112	113	I-10/SR 85 Jct. Ramp Improvements	-	Modify all 4 entry/exit ramps at I-10/SR 85 Jct. to parallel configuration	M
CS 85.15	L26, L27	155	149	Buckeye Safety Improvements	A B	Install chevrons on the I-10/SR 85 interchange ramps Install dynamic warning signs on SR 85 at intersection approaches for Broadway, Southern and Baseline Increase size and visibility of stop signs at Broadway, Southern, and Baseline (both directions) Install intersection warning beacons along Broadway, Southern, and Baseline (both directions) Add acceleration and deceleration lanes for cross-traffic merging at Southern and Broadway Construct grade separations at Broadway, Southern, Baseline/UPRR, and MC-85	M
CS 85.16	L33	123	120	North Gila Bend SB GP Lanes	A B	Construct 2 SB GP lanes west of existing alignment to create 4 lane divided highway between MP 123 and Maricopa Rd. Existing alignment to become 2 NB GP lanes Widen to two lanes in each direction	E
CS 85.17	L38, L39	120	123	Butterfield Trail Mobility Improvements	A B	Widen to two lanes in each direction w/ center left turn lane Widen to add center left turn lane and widen shoulder on both sides	E/M

\* "-" indicates only one solution is being proposed and no options are being considered

Figure 5: Candidate Solutions



## 4.4 Other Corridor Recommendations

Besides the aforementioned candidate solutions, the I-10/SR 85 Corridor was evaluated to determine if other corridor-specific solutions might be appropriate. These solutions would still be strategic but would involve corridor-specific programs or initiatives rather than location-based projects. The following corridor-specific solutions were identified for the I-10/SR 85 Corridor:

- When recommending future projects along the I-10/SR 85 Corridor, review historical ratings and levels of investment. According to data used for this study, the following pavement and bridge locations have exhibited high historical investment (pavement) or rating fluctuation (bridge) issues:
  - Pavement I-10 MP 0-16
  - Pavement I-10 MP 54-71
  - Tom Wells Rd TI (I-10 MP 5.84)
- Consider I-10 west of SR 85 TI a safety corridor
- Support the long range plan to connect SR 85 to I-8 via a new TI in Gila Bend
- Consider long range vision of extending SR 85 south of I-8 to bypass Gila Bend Main Street

## 4.5 Policies and Initiatives

In addition to location specific needs, general corridor and system wide needs were also identified through the corridor profile process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them as well. Therefore, a recommended policies and initiatives list was developed for consideration when programming future projects not only on I-10/SR 85, but across the entire state highway system where the conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1 and Round 2 Corridor Profile Studies.

- Install ITS conduit with all new infrastructure projects.
- Prepare strategic plans for Closed Circuit Television (CCTV) and Road Weather Information System (RWIS) locations statewide.
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state.
- Consider solar power for lighting and ITS where applicable.
- Investigate ice formation prediction technology where applicable.
- Conduct highway safety manual evaluation for all future programmed projects.
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects.
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work.

- Review historical ratings and investment level during scoping of all new pavement and bridge projects. In areas that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted.
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project.
- Expand programmed and future pavement projects as necessary to include shoulders.
- Expand median cable barrier guidelines to account for safety performance.
- Install CCTV with all DMS.
- In locations with limited communications, use CCTV to provide still images rather than streaming video.
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data.
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16 feet 3 inches where feasible.

## 5.0 NEXT STEPS

Candidate Solutions identified in Working Paper 5 will advance to be evaluated in multiple ways including a Life Cycle Cost (where applicable), Risk Analysis, and a Performance Effectiveness Analysis. The methodology and approach to this analysis is briefly described below and will be documented in detail in Working Paper #6. **Figure 6** illustrates the candidate solution evaluation process.

**Life Cycle Cost Analysis** – All pavement and bridge candidate solutions have two options, rehabilitate the area of need, or fully reconstruct the issue area or structure. These options will be evaluated through a life cycle cost analysis to determine the best approach for each location where a pavement or bridge solution is recommended. The recommended option will be advanced to the Performance Effectiveness and Risk Analysis evaluations.

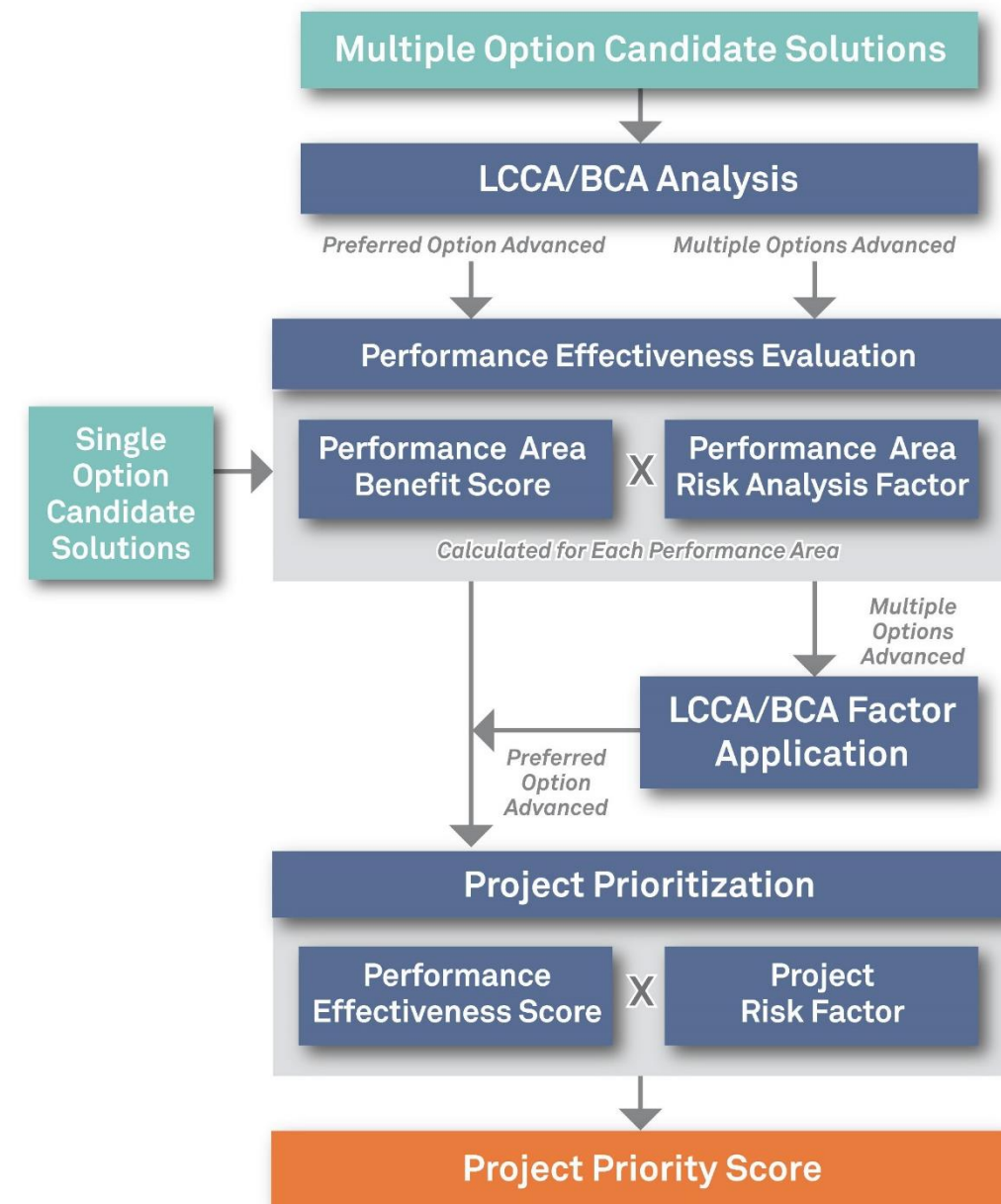
**Performance Effectiveness Evaluation** – After the LCCA process is complete, all remaining candidate solutions will be evaluated based on their performance effectiveness. This process will include determining a performance effectiveness score based on how much each solution increases existing segment level performance scores identified in Working Paper #2 and how much the segment level need in Working Paper #4 is decreased. The results of this evaluation will be combined with the results of the Risk Analysis to determine which solutions have the highest priority in the I-10/SR 85 corridor.

**Risk Analysis** – All candidate solutions that are advanced through the Performance Effectiveness evaluation will also be evaluated through a Risk Analysis process. This process will examine the risk of not implementing a recommended solution in terms of overall corridor performance. The results of this analysis will be combined with the Performance Effectiveness scores to determine the highest priority solutions in the I-10/SR 85 Corridor.

The highest ranking solutions will become recommended strategic investments for implementation and compared to recommendations developed through other processes, such as the Programming to Projects Link (P2P) process.

Strategic investments are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and consultants develop candidate projects for consideration in performance-based programming in the P2P Link process. Rather, these strategic investments are intended to complement ADOT's traditional project development processes with non-traditional projects to address performance needs in one or a combination of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Strategic investments developed for strategic corridors will be considered along with other candidate projects in the ADOT programming process.

**Figure 6: Candidate Solution Evaluation Process**



## **APPENDIX A:**

### ***Solution Types***

## PRESERVATION

### REHABILITATION

- Rehabilitate Pavement
- Rehabilitate Bridge

## MODERNIZATION

### GEOMETRIC IMPROVEMENT

- Re-profile Roadway
- Realign Roadway
- Improve Skid Resistance

### INFRASTRUCTURE IMPROVEMENT

- Reconstruct to Urban Section
- Construct Auxiliary Lanes
- Construct Climbing/Passing Lane
- Construct Reversible Lane
- Construct Entry/Exit Ramp
- Construct Turn Lanes
- Modify Entry/Exit Ramp
- Replace Pavement
- Replace Bridge
- Widen Bridge
- Install Pedestrian Bridge
- Implement Automated Bridge De-icing
- Install Wildlife Crossing
- Construct Drainage Structure

### OPERATIONAL IMPROVEMENT

- Implement Variable Speed Limits
- Implement Ramp Metering
- Implement Lane Control
- Implement Shoulder Running
- Implement Signal Coordination/Adjust Timing
- Implement Protected Left-turn Signal Phasing

### ROADSIDE DESIGN

- Install Guardrail
- Install Cable Barrier
- Widen Shoulder
- Rehabilitate Shoulder
- Replace Shoulder
- Install Rumble Strip
- Install Safety Edge
- Install Wildlife Fencing
- Remove Tree/Vegetation
- Install Centerline Rumble Strips
- Install Access Barrier Fence
- Install Rock-Fall Mitigation
- Install Raised Concrete Barrier in Median

## INTERSECTION IMPROVEMENT

- Construct Traffic Signal
- Improve Signal Visibility
- Install Raised Median
- Install Transverse Rumble Strips / Pavement Markings
- Single Lane Roundabout
- Double-Lane Roundabout

## ROADWAY DELINEATION

- Install High-Visibility Edge Line Striping
- Install High-Visibility Delineators
- Install Raised Pavement Markers
- Install In-lane Route Pavement Markings

## IMPROVED VISIBILITY

- Cut Side Slopes
- Install Lighting

## DRIVER INFORMATION/WARNING

- Install Dynamic Message Sign (DMS)
- Install Dynamic Weather Warning Beacons
- Install Speed Feedback Signs
- Install Chevrons
- Install Warning Signs
- Install Wildlife Warning System
- Install Warning Signs with Beacons
- Install Larger Stop Sign with Beacons

## DATA COLLECTION

- Install Road Weather Information System (RWIS)
- Install Closed Circuit Television (CCTV) Camera
- Install Vehicle Detection Stations
- Install Flood Sensors

## EXPANSION

### WIDEN CORRIDOR

- Construct New General Purpose Lane
- Construct 4-lane Divided Highway (Using 2-lane Road for One Direction)
- Construct 4-lane Divided Highway (No use of Existing Roads)
- Construct 2-lane Highway
- Construct Bridge over At-Grade Railroad Crossing
- Construct Underpass at At-Grade Railroad Crossing
- Construct High-Occupancy Vehicle (HOV) Lane
- Install Center Turn Lane

### ALTERNATE ROUTE

- Construct Frontage Roads